REMARKS/ARGUMENTS

Favorable reconsideration of this application, as presently amended and the following remark, is respectfully requested.

Claims 1, 5-7, 9-11, 15 and 18-19 are pending in this amendment. By this amendment, the Abstract is amended; Claims 1, 5-7, 9-11, 15 and 18-19 are amended; Claims 8, 13-14, 17 and 20-22 are canceled; and no claims are added herewith. The amendments to Claims 1 and 11 are supported by at least page 10, lines 15 to 17; page 13, lines 16 to 18; page 16, lines 15 to 18; and line 26 of page 20 to line 2 of page 21. It is respectfully submitted that no new matter is added by this amendment.

In the outstanding Office Action, Claims 1, 5, 7, 11, 17-19 and 21 were rejected under 35 U.S.C. § 112, first paragraph; Claims 1, 5, 7, 11, 17-19 and 21 were rejected under 35 U.S.C. § 112, second paragraph; Claims 1, 5-7, 9 and 10 were rejected under 35 U.S.C. § 103(a) as unpatentable over JP 2000-331998 to Kazumi in view of U.S. Patent No. 5,234,526 to Chen; Claim 11 was rejected under 35 U.S.C. § 103(a) as unpatentable over Kazumi in view of U.S. 2002/0038692 to Ishii; and Claims 13-15 and 17-22 were rejected under 35 U.S.C. § 103(a) as unpatentable over Kazumi, Ishii and further in view of U.S. Patent No. 5,234,526 to Chen.

With respect to the rejection of the claims under 35 U.S.C. § 112, first and second paragraphs, the claims are amended by the present amendment to clarify the features recited therein. Accordingly, withdrawal of the § 112 rejections is respectfully requested.

The applied art does not teach or suggest, a plasma processing apparatus including a chamber for accommodating therein the substrate; a dielectric top plate member disposed on an upper portion of the chamber; an antenna having a plurality of slots for irradiating a microwave towards an inside of the chamber through the top plate member, the antenna being disposed on the top plate member and being in close contact with the top plate member; a gas

injection opening for supplying a processing gas into the chamber; and a vacuum pump for exhausting an inside of the chamber, as recited in Claim 1. Further, Claim 1 recites that the top plate member includes a dielectric flat plate portion formed to face the substrate; and a dielectric sidewall portion formed to extend from a peripheral region of the flat plate portion towards the substrate. Sides of the flat plate portion and the sidewall portion facing a plasma generation region have a curved surface extending between the flat plate portion and the sidewall portion and the sidewall portion has a thickness not smaller than $\lambda_g/4$ but not greater than λ_g (λ_g is the wavelength of the microwave based on the dielectric constant of the top plate member).

In accordance with the features of the claimed invention, since the sidewall portion has the thickness equal to or greater than $\lambda_g/4$, standing waves can be formed in the sidewall portion. Furthermore, since the sides of the flat plate portion and the sidewall portion facing the plasma generation region have a smooth and curved surface extending between the flat plate portion and the sidewall portion, reflection of the microwave is suppressed when the microwave propagates from the flat plate portion to the sidewall portion, so that the microwave efficiently propagates to the sidewall portion. Therefore, the standing waves are efficiently formed in the sidewall portion by the microwave propagated thereto, and the microwave having a greater power can be supplied towards a part corresponding to a periphery portion of the substrate in the plasma generation region. As a result, the plasma density in the plasma generation region can be increased and, at the same time, the uniformity of the plasma density is further improved, whereby the plasma processing can be performed more uniformly on the substrate.

In contrast, Kazumi discusses a metal vessel 20 including a vessel housing 23 therein. The vacuum housing 23 (which corresponds to the top plate member of the present invention) is a truncated cone shape. The vacuum housing 23 has a flat upper surface 23A (which

corresponds to the flat plate portion of the present invention) on which a circular metal plate 50 (which corresponds to the antenna of the present invention) is disposed and a tapered surface 23B (which corresponds to the sidewall portion of the present invention). A cavity part 25 is formed between a wall of the metal vessel 20 and the outer wall of the vacuum housing 23.

In Kazumi, since the vacuum housing 23 is the truncated cone shape, the sides of the upper surface 23A and the tapered surface 23B facing the plasma generation region does not have a smooth and curved surface extending between the upper surface 23A and the tapered surface 23B. Therefore, the structure of the vacuum housing 23 of Kazumi is different from one or more examples of the present invention. As such, the above described effectiveness of the present invention cannot be obtained by Kazumi.

When a microwave is propagated through members having different dielectric constants, a standing wave and a reflected wave can be easily generated so that it is difficult to provide an inside of a plasmas processing space with the microwave uniformly. Thus, in Kazumi, since the microwave is provided through the cavity part 25, slits 50A of the metal plate 50 and the upper surface of 23A, and the tapered surface 23B, respectively, it is difficult to provide the inside of the plasmas processing space with the microwave uniformly.

Chen discusses a dielectric microwave/transformer window (which corresponds to the top plate member of the present invention) with a characteristic cross-section. However, Chen does not disclose an antenna having a plurality of slots for irradiating a microwave toward an inside of a plasma generation chamber. Therefore, the features of the claimed invention in view of the teachings of Kazumi and Chen, are not provided in the applied art. Claim 1.

With respect to Claim 11, the applied art does not teach or suggest a plasma processing apparatus that includes a chamber for accommodating therein the substrate; a

dielectric top plate member disposed on an upper portion of the chamber; an antenna having a plurality of slots for irradiating a microwave towards an inside of the chamber through the top plate member, the antenna being disposed on the top plate member and being in close contact with the top plate member; a gas injection opening for supplying a processing gas into the chamber; and a vacuum pump for exhausting an inside of the chamber. As recited in Claim 11, the top plate member includes a dielectric flat plate portion formed to face the substrate; and a dielectric sidewall portion formed to extend from a peripheral region of the flat plate portion towards the substrate. Sides of the flat plate portion and the sidewall portion facing a plasma generation region have a curved surface extending between the flat plate portion and the sidewall portion and a gap instance between the top plate member and the antenna is equal to or smaller than $\lambda_g/10$ (λ_g is a wavelength of the microwave).

In accordance with the features recited in Claim 11, the dielectric sidewall portion as well as the dielectric flat plate portion is formed in the top plate member, so that a region (area) of the top plate member facing the plasma generation region can be increased. Further, since the microwave is irradiated into the chamber from the sidewall portion, the plasma density at the plasma generation region can be enhanced.

In addition, the distribution of the electromagnetic field inside the top plate can be changed by the electromagnetic field generated in the gap between the top plate and the antenna, if there is a gap greater than 1/10 of the microwave wavelength. Therefore, the change of the distribution of the electromagnetic field inside the top plate can be prevented by making the width of gap equal to or smaller than $\lambda_g/10$.

In contrast, Kazumi discusses a metal vessel 20 including a vessel housing 23 therein. The vacuum housing 23 (which corresponds to the top plate member of the present invention) is a truncated cone shape. The vacuum housing 23 has a flat upper surface 23A (which corresponds to the flat plate portion of the present invention) on which a circular metal plate

50 (which corresponds to the antenna of the present invention) is disposed and a tapered surface 23B (which corresponds to the sidewall portion of the present invention). A cavity part 25 is formed between a wall of the metal vessel 20 and the outer wall of the vacuum housing 23. In Kazumi, since the vacuum housing 23 is the truncated cone shape, the sides of the upper surface 23A and the tapered surface 23B facing the plasma generation region does not have a smooth and curved surface extending between the upper surface 23A and the tapered surface 23B. Therefore, the structure of the vacuum housing 23 of Kazumi is different from the features of the claimed invention. As discussed with respect to Claim 1 above, when a microwave is propagated through members having different dielectric constants, it is difficult to provide an inside of a plasmas processing space with the microwave uniformly. Thus, in Kazumi, since the microwave is provided through the cavity part 25, slits 50A of the metal plate 50 and the upper surface of 23A, and the tapered surface 23B, respectively, it is difficult to provide the inside of the plasmas processing space with the microwave uniformly.

Ishii discusses a radial antenna 30 and a dielectric plate 13 (which corresponds to the top plate member of the present invention). However, in Ishii, the antenna 30 is not in close contact with the dielectric plate 13. Instead, there is a gap between the antenna 30 and the dielectric plate 13. Therefore, the structure of the plasmas processing apparatus of the present invention is different from that of Ishii. Therefore, no combination of Kazumi and Ishii indicate or suggest the above features of Claim 11. Therefore, the above described effectiveness of Claim 11 cannot be achieved by Kazumi and Ishii.

Accordingly, it is respectfully requested that the rejection of the claims under 35 U.S.C. § 103(a) be withdrawn.

Consequently, for the reasons discussed in detail above, no further issues are believed to be outstanding in the present application, and the present application is believed to be in condition for formal allowance. Therefore, a Notice of Allowance is earnestly solicited.

Should the Examiner deem that any further action is necessary to place this application in even better form for allowance, the Examiner is encouraged to contact the undersigned representative at the below listed telephone number.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
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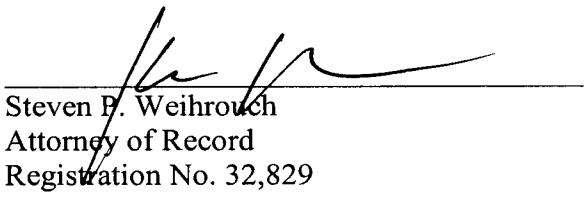

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